

C. William
Swank Program
in Rural-Urban Policy

TAKING MEASURE OF OHIO'S OPIOID CRISIS

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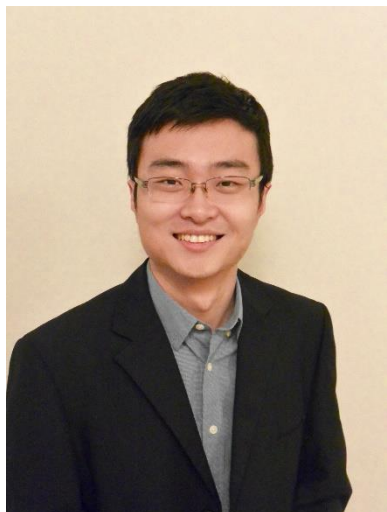
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About the C. William Swank Program in Rural-Urban Policy

The C. William Swank Program in Rural-Urban Policy is a nationally and internationally recognized research and outreach program focused on priority issues related to rural and urban communities and their growth and prosperity.

Led by Professor Mark Partridge, the Swank Program combines innovative approaches in economic theory, planning, advanced statistical research, and geographical information systems to create products that can be used by the academic community, stakeholders, policymakers, students, and the public. In turn, the Swank Program will help inform and facilitate teaching and student research at Ohio State and elsewhere.

The Swank Program conducts and supports research, teaching, and outreach within the College of Food, Agricultural, and Environmental Sciences; the Ohio Agricultural Research and Development Center; and Ohio State University Extension.

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Executive Summary

Opioid addiction, abuse, and overdose deaths have become the most pressing public health issue facing Ohio. Ohio leads the country in drug overdose deaths per capita, a rate that continues to rise, overwhelming families, communities, and local governments across the state. In this policy brief, we aim to contribute to the understanding of this unfolding crisis and highlight insights that can inform policymaking.

One important motivation for us to consider this topic is its significant costs. We estimate that there were likely 92,000 to 170,000 Ohioans abusing or dependent upon opioids in 2015, resulting in annual costs associated with treatment, criminal justice, and lost productivity of \$2.8 billion to \$5.0 billion. Additionally, we estimate that the lifetime lost productivity of those who died from an opioid overdose in 2015 to be \$3.8 billion, for **an annual total cost of opioid addition, abuse, and overdose deaths ranging from \$6.6 billion to \$8.8 billion**. To put this into perspective, Ohio spent \$8.2 billion of General Revenue Funds and Lottery Profits money on K-12 public education in 2015, thus, the opioid crisis was likely as costly as the state's spending on K-12 education.

The emergence of the opioid crisis has been unevenly distributed across the state. We consider the relationship between drug overdose deaths in 2015 and several county level economic, demographic, and health factors. We find that areas of the state experiencing lagging economic growth and low economic mobility had higher drug overdose death rates. We also find that overdose deaths were strongly linked to educational attainment. **In 2015, the drug overdose rate for those in Ohio with just a high school degree was 14 times higher than those with a college degree.** Finally, we note the link between prescription opioids and overdose rates, finding that counties that had higher levels of prescription opioids per capita in 2010 also had higher overdose death rates in 2015.

Research has shown that the most clinically and cost effective method for reducing opioid addiction, abuse, and overdose death is medication-assisted treatment. We consider the prominent treatment options, and discuss their availability across the state. **We estimate that in the best-case scenario, Ohio likely only has the capacity to treat 20-percent to 40-percent of population abusing or dependent upon opioids.** We find distinct geographic disparities in access to treatment, especially between urban and rural areas of the state. Many people in rural areas of Ohio have extremely limited access to medication-assisted treatment. This is a particularly critical issue in the rural areas of Southwest Ohio where opioid abuse rates are high but local access to treatment is limited.

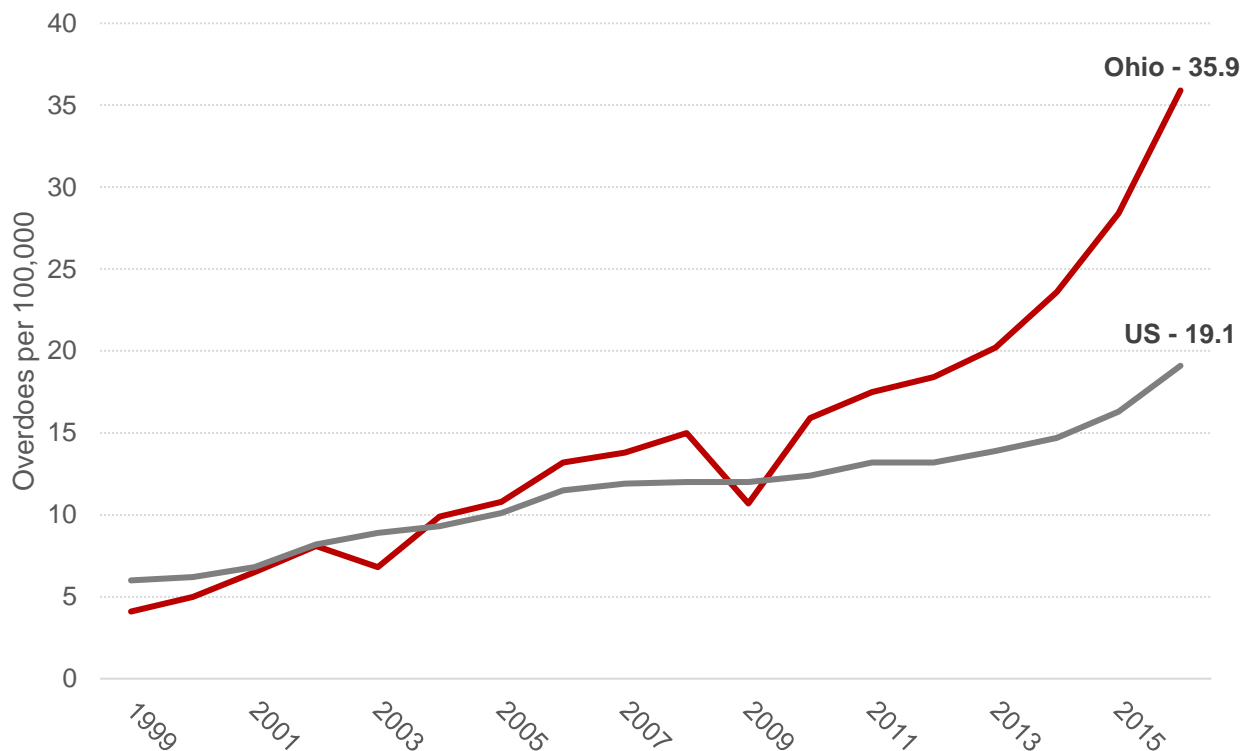
We conclude by offering two policy recommendations based on our analysis. **In the near term, the state should prioritize expanding access to treatment in underserved areas.** This would require working with physicians and hospitals in underserved areas to encourage providers to obtain the waiver required to prescribe opioid treatments to their patients. We note that Vermont offers an excellent model for expanding access to opioid treatment. **In the long term, the state should focus on improving the labor market outcomes of residents in areas severely impacted by the crisis.** Specifically, we recommend that the state focus on improving educational investments in as a way of deterring drug abuse and overdose, particularly noting the substantial evidence linking early childhood interventions on improved employment outcomes later in life.

I. Introduction: Ohio's Opioid Crisis

On August 10th, 2017, President Trump declared the opioid epidemic a national emergency.¹ Ohio leads the nation in per capita overdose deaths and has become the posterchild of the crisis in national media. Although the rise in opioid-related deaths has been well-documented, research identifying the epidemic's underlying causes and evaluations of early policy interventions have only recently come to the fore. This policy brief aims to apply recent findings to Ohio's specific context and provide evidence-based policy recommendations.

The rapid rise of drug overdose deaths in the United States and Ohio is unprecedented. Prior to the turn of the millennium, the national overdose rate was about six per 100,000 people. Estimates of the overdose rate in 2016 suggest it has more than tripled in less than two decades. Ohio's increase is even more startling, growing almost nine-fold between 1999-2016. Figure 1 demonstrates the rapid rise of overdose deaths in the U.S. and Ohio. Currently, the number of overdose deaths are greater than the peak number of car crash deaths (1973), AIDS deaths (1995), and gun-related deaths (1993) (Katz 2017). Drug overdoses are now the leading cause of death for Americans under 50 years old nationally (Quinones 2017).

FIGURE 1: Drug Overdose Rates 1999-2016



SOURCE: CDC WONDER Compressed Mortality Files 1999-2015, Ohio 2016 data from Ohio Public Health Data Warehouse, US 2016 data from NY Times

¹ Though at the time of press, a formal legal declaration has yet to be made

Table 1 demonstrates the magnitude of the crisis with respect to other causes of death in Ohio. Overdose deaths are now the leading cause of death for Ohioans under the age of 55 and the sixth leading cause of death overall.² More than two and a half times as many people die from drug overdoses than in car accidents in Ohio.

TABLE 1: Causes of Death in Ohio - 2015

Cause³	Deaths Under Age 55	Total Deaths
Overdoses	2,744	3,304
Cancer	2,580	25,396
Heart disease	2,188	28,069
Suicide	1,088	1,650
Car crashes	794	1,259
Homicide	577	669
Chronic liver disease	440	440
Diabetes	378	3,645
Chronic lower respiratory	300	7,211

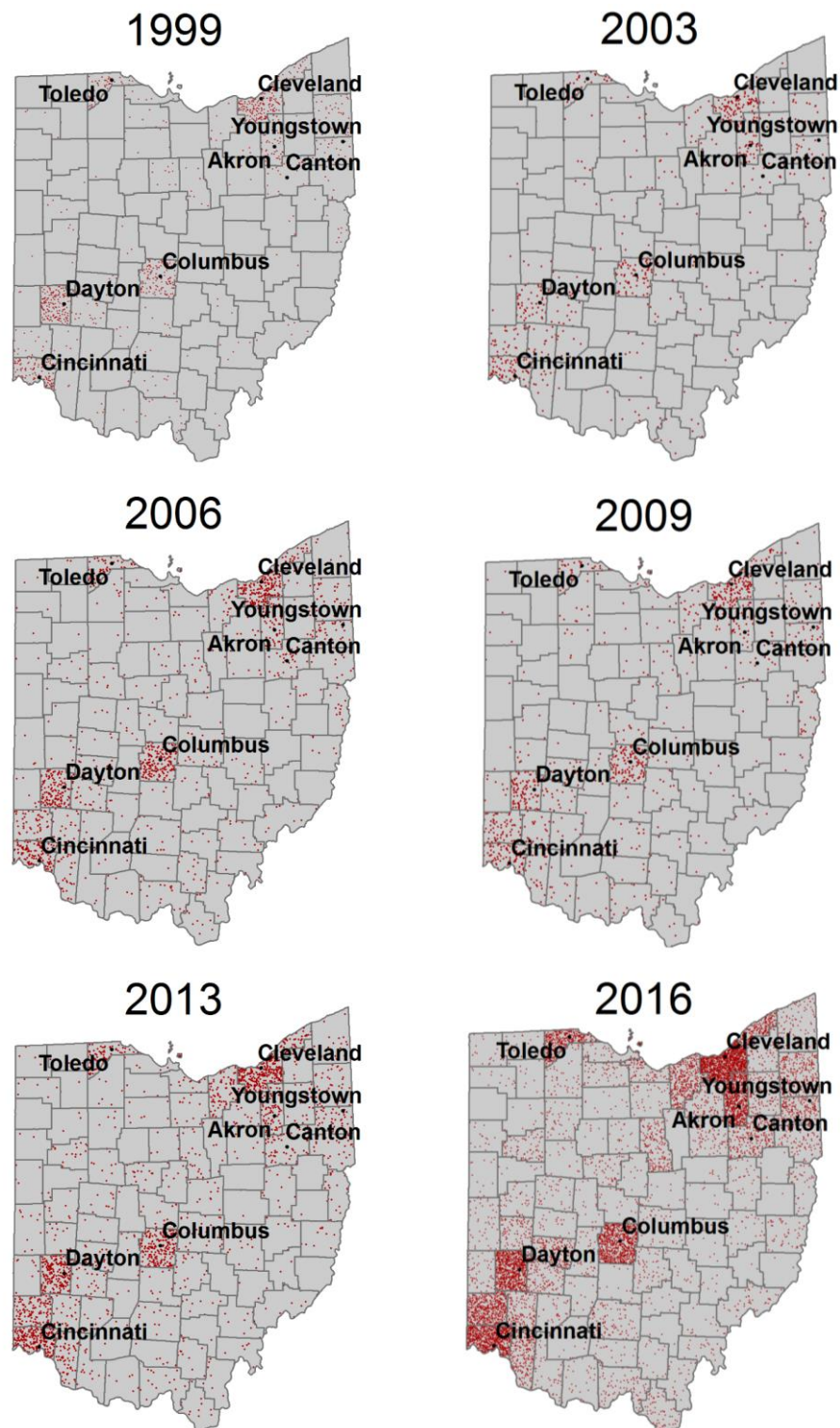
SOURCE: CDC WONDER Compressed Mortality Files 1999-2015

The crisis is not, however, spread equally across Ohio. Figure 2 shows the geographic evolution of overdose deaths between 1999 and 2016. Each dot on the map represents one death. In 1999, drug overdose deaths were largely concentrated in the urban core areas Ohio's major cities—Columbus, Cincinnati, Cleveland/Akron, Toledo and Dayton—with only a few overdose deaths in non-metro areas. By 2016, overdose deaths had spread drastically across the state, and every county in Ohio had at least one overdose death.

² Using 2016 estimates, overdose rates are the 5th leading cause of death overall in Ohio

³ IDC 10 codes for cause of death: Overdoses (X40-44, X60-64, Y10-14), Cancer (C00-C97), Heart disease (I00-I09, I11, I13, I20-I51), Suicide (X60-X84, Y87.0), Car crashes (V02-V04, V09.0, V09.2, V12-V14, V19.0-V19.2, V19.4-V19.6, V20-V79, V80.3-V80.5, V81.0-V81.1, V82.0-V82.1, V83-V86, V87.0-V87.8, V88.0-V88.8, V89.0, and V89.2), Homicide (U01-*U02, X85-Y09, Y87.1), Chronic liver disease (K70, K73-K74), Diabetes (E10-E14), Chronic lower respiratory (J40-47), Influenza and Pneumonia (J09-18), Kidney disease (N00-N07, N17-N19, N25-N27), Alzheimer's (G30)

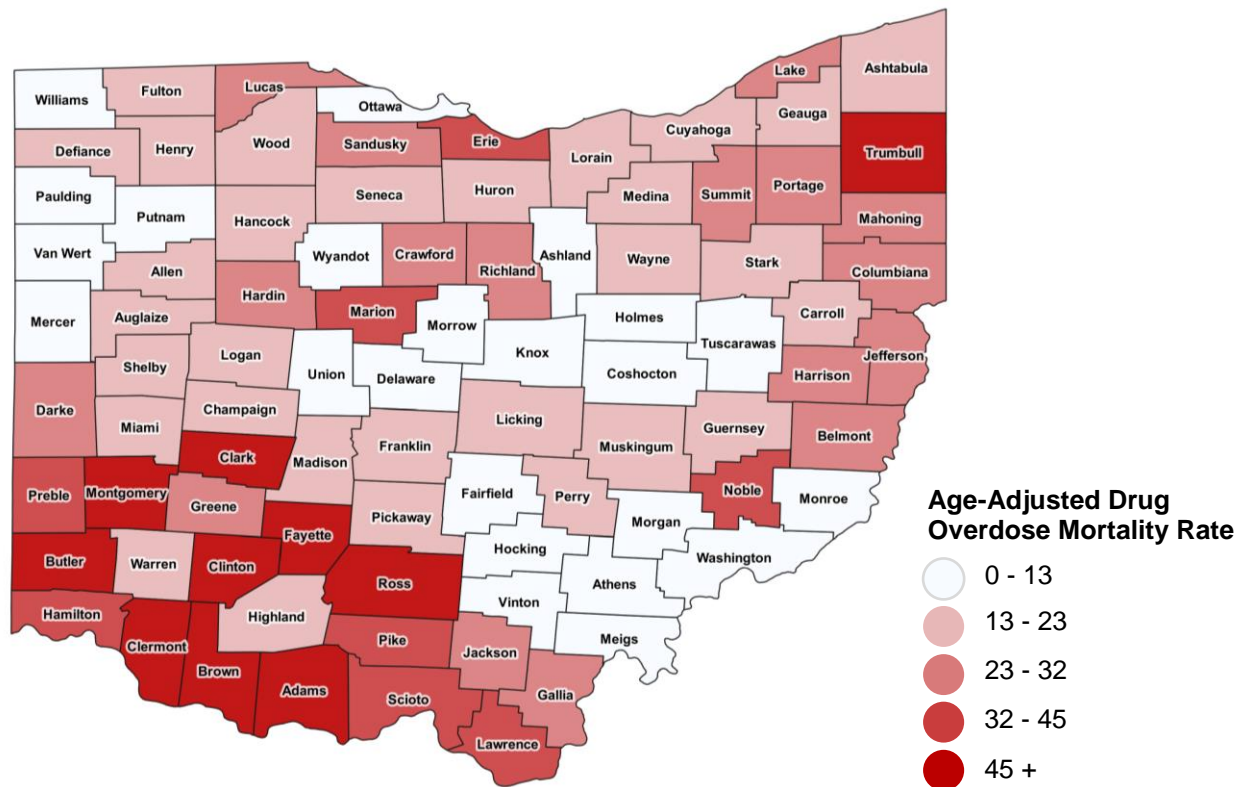
FIGURE 2: The spread of opioid overdoses in Ohio



NOTE: Overdose deaths 1999-2016. One dot represents one death. Source CDC Compressed mortality files 1999-2006, Ohio

As the opioid crisis has spread, it has affected both urban and rural communities. Figure 3 shows the age-adjusted overdose rates for Ohio counties in 2015. In 2015, only one of the top ten counties with the highest overdose rates (overdose deaths per 100,000 people) encompassed a large urban core (Montgomery County - Dayton), four of the top ten were rural, while the remaining were either suburban areas or small cities.

FIGURE 3: 2015 Age-Adjusted Drug Overdose Mortality Rates



SOURCE: Ohio Department of Health; NOTE: Overdose death count per 100,000 used where age adjusted rate is unavailable

Most analysis of opioid addiction and abuse focuses on overdose deaths because it captures the gravity of the crisis and because it is the most consistently collected data on the issue. Yet, opioid overdose deaths are only representative of the broader population of people abusing or addicted to opioids that policies should target. To analyze the full scope of Ohio's opioid problem we need to know the scale of the opioid abuse and dependency in the state.

Data on overdose deaths is far more accessible than data on opioid addiction and abuse. Data on opioid usage and dependency can only be collected through surveys, which are expensive to perform and can suffer from inaccuracies due to the hesitancy among survey respondents to

answer honestly on questions about drug abuse. Opioid overdose data is collected from death records, which are complete and less likely to suffer from inaccuracies.

In order to evaluate the full extent of the opioid crisis in Ohio, we construct an estimate that we use throughout the paper for the number of Ohioans that are abusing or dependent upon opioids. This estimate begins using survey response data from the most comprehensive national survey of drug use conducted by the US Department of Health and Human Services. The survey estimates that one percent of the US population 12 years and older abused opioids or had an opioid dependency in 2015. These estimates include illegal use of prescription opioids (0.8-percent) and heroin (0.2-percent). Unfortunately, similar data is not available at the state level. In our first estimate, we use this one percent share to calculate the number of opioid abusers in the state of Ohio (using the share of the population 16 and older).⁴

Using this procedure, we estimate that there were 92,000 Ohioans abusing or dependent upon opioids in 2015 (Table 2). We consider this a lower bound estimate given that Ohio ranks third nationally in the rate of opioid overdose deaths. This likely reflects a much higher than average level of opioid abuse, so using the national level will produce very conservative estimates. We utilize a weighting technique to correct for the fact that Ohio likely has a higher level of opioid abuse and dependency than the country as a whole. The weight is constructed using the ratio of Ohio's 2015 drug overdose rate to the national drug overdose rate in 2015. Using this weighting procedure, our estimate increases to 170,000 Ohioans abusing or dependent upon opioids in 2015.

TABLE 2. Estimated Population with Opioid Abuse/Dependency Disorder - 2015

	One percent share of pop abusing or addicted to opioids (Lower Bound Estimate)	Weighted share (Upper Bound Estimate)
Estimated Number of Ohioans with Opioid Abuse or Dependency Disorders	92,000	170,000

To put these estimates into a health context, in 2015 there were 62,000 new cancer cases in Ohio (Ohio Department of Health et al, 2016). We can also frame these numbers in economic terms. In 2016, the active Ohio labor force was 5.7 million people, down from a peak of 6 million in 2007 (BLS). If we consider the change over time, there were 300,000 fewer active workers in the labor force in 2016 than 2007. Given that opioid dependency and abuse can limit a person's

⁴ Estimates for the population 12 years old and older is not readily available from the American Community Survey, thus we use the more commonly used 16 years and older. In 2015, there were no opioid overdose deaths among the population under 15 years old, so we assume the number of opioid abusers 12 to 14 is small.

ability to participate in the labor force, one way at looking at the estimates for opioid abuse and dependency is that it could account for a third to more than a half of the decline in workforce participation since 2007.

Ohio is clearly experiencing one of the most serious health crises to face working age adults in the past 50 years. This brief will discuss factors that have contributed to the genesis of the crisis from both the supply side (increases in opioid availability) and demand side (possible reasons Ohioans demand opioids). We will also cover treatment options and the costs of the crisis. We will conclude with some policy recommendations aimed at addressing the immediate need to reduce opioid addiction, abuse, and overdoses, as well as the long term need to prevent drug related crises in the future.

II. The Costs of the Opioid Crisis

The personal and social costs of opioid addiction and abuse is high for drug users, their families, and their communities, but it also has economic costs. Addressing the opioid crisis is not just a public health issue; it is a significant economic issue.

The costs associated with opioid addiction are broadly distributed across four categories: health care and treatment costs, criminal justice costs, lost productivity among current opioid abusers, and lost productivity of drug overdose deaths. Florence et al. (2016) estimate that opioid abuse resulted in total social costs of more than \$78 billion in 2013. Medical care and substance abuse treatment for opioid abusers was the largest share of total costs, accounting for 38 percent of total costs (\$28.9 billion). They found that patients with opioid abuse had average annual health care costs that were \$13,000 greater than for similar patients that were not abusing opioids.

Twenty-seven percent (\$21.5 billion) of the costs resulted from the lost productivity of those who died from opioid overdoses. This measure of lost productivity captures the expected lifetime earnings of individuals that died from opioid overdose. This estimate suggests average lost lifetime earnings of \$1.3 million per opioid overdose death. Each additional year of productive life is valuable to both the individual and society. Due to the high social value of productive individuals, efforts to reduce opioid overdoses have significant benefits for society. Coffin and Sullivan (2013) find that even under extremely conservative scenarios, programs which distribute naloxone—a drug which counteracts opioid overdoses—to opioid abusers are highly cost-effective for society.

Twenty-six percent of total costs resulted from lost productivity of surviving opioid abusers. It has been estimated that opioid abuse reduces productivity by 17 percent among males and by 18 percent among females (National Drug Intelligence Center). Finally, ten percent resulted from spending on criminal justice, of which 96 percent was directly funded by state and local governments.

The costs of opioid addiction and abuse are born by both public and private entities. Florence et al. (2016) estimate that one quarter of the costs of opioid abuse is funded by public sources. In 2013, Medicare and Medicaid covered just over ten percent of these costs.

We use estimates for non-fatal opioid addiction and abuse costs from Florence et al. (2016) and fatal costs estimates from the Center for Disease Control to calculate the cost of opioid abuse in Ohio in 2015. Column 1 of Table 3 presents the cost estimates based on the conservative assumption that the opioid abuse and dependence rate in Ohio is equal to the national average (one percent). Using this conservative method, we estimate non-fatal costs⁵ to be \$2.8 billion. To obtain an upper bound estimate, we utilize the weighting technique discussed in the introduction, suggesting a non-fatal cost of \$5 billion. This gives us a reasonable range for the costs of non-fatal opioid abuse and dependency in 2015, ranging from \$2.8 billion to \$5.0 billion.

The cost of drug overdose fatalities in Ohio, most of which resulted from opioid abuse, is calculated using the Center for Disease Control and Prevention's (CDC) cost of fatal accidents module which calculates the lost lifetime productivity of fatal incidents of drug overdose deaths accounting for the age and gender of the deceased. In 2015, opioid overdoses resulted in \$3.8 billion in lost lifetime productivity in Ohio. In total, the cost of opioid abuse and dependency ranged from \$6.6 billion to \$8.8 billion.

TABLE 3. Cost of Opioid Abuse & Dependency - Ohio 2015

	Using one percent share of opioid abusers (Lower Bound Estimate)	Using weighted share (Upper Bound Estimate)
Non-Fatal Costs	\$2.8 billion	\$5.0 billion
Fatal Costs	\$3.8 billion	\$3.8 billion
Total Costs	\$6.6 billion	\$8.8 billion
Cost Per Capita	\$560	\$756

Using the weighting procedure, we estimate the cost per capita of opioid abuse for Ohio counties. It is important to note that these estimates are not exact, as several simplifying assumptions are made to generate these estimates. Similarly, it is important to keep in mind that these costs are not all born by the citizens within the county. For example, costs associated with medical treatment are paid for by a variety of sources, including private insurers and the federal government. Similarly, both local governments and the state government often pay for the criminal justice costs associated with opioid abuse. Yet, these estimates do likely reflect real differences in the economic burden of opioid abuse across Ohio counties.

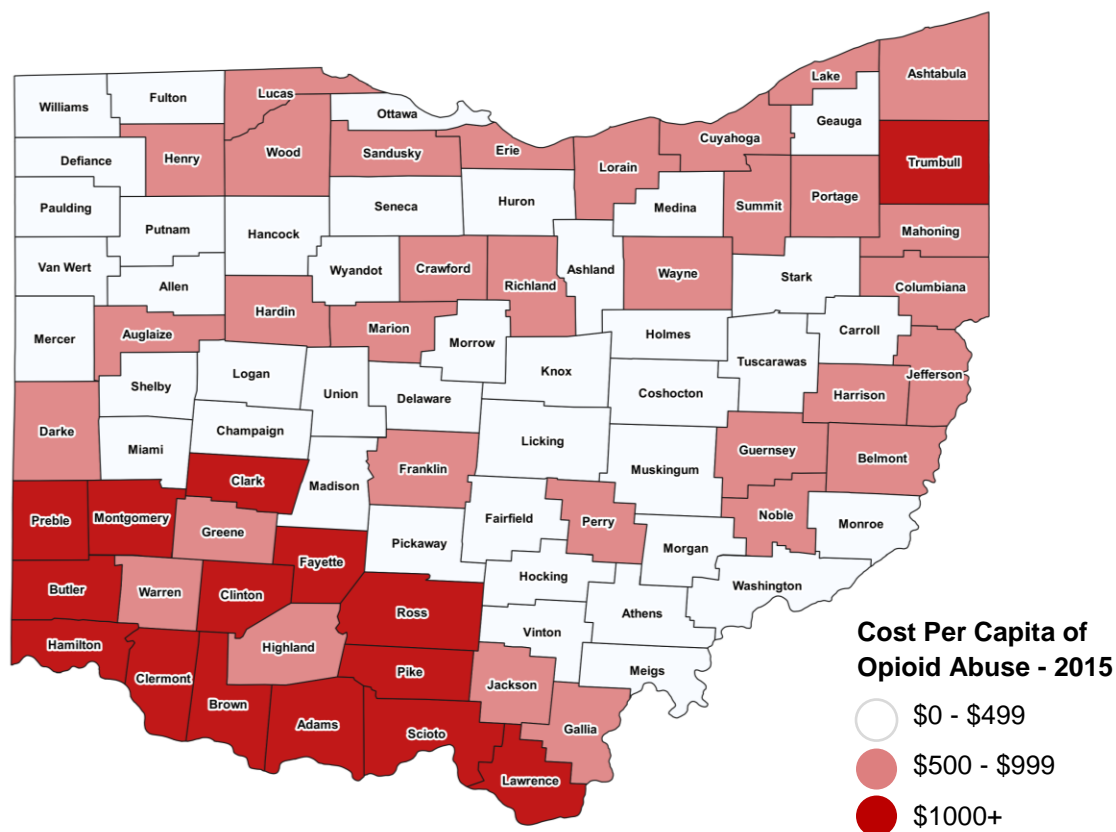
The per capita costs vary greatly across the state, reflecting the variation in the severity of opioid abuse (Figure 4). In 2015, Clark and Brown counties each had per capita costs associated with opioid abuse of more than \$1,400 per capita, while five counties in the state had

⁵ Non-fatal costs include health care costs, treatment costs, criminal justice costs, and lost productivity among opioid abusers

costs of less than \$100 per capita. The highest per capita costs were concentrated in the southwest quadrant of Ohio where per capita costs were more than \$1,000 in most counties.

Quantifying the economic costs of opioid abuse is critical to craft effective policy. Ideally, policymakers would use such estimates to evaluate the costs and benefits of measures which seek to reduce the harmful use of opioids. Yet, these costs are unevenly distributed across the state. Communities in southwest Ohio bare the largest costs of opioid abuse, and state efforts to reduce current and future opioid abuse should likely focus on this area of the state.

FIGURE 4: Cost Per Capita of Opioid Abuse – 2015



SOURCE: Authors' calculation

III. The Socio-Economic Characteristics of the Opioid Crisis

Understanding the root causes and the factors of that contributed to the genesis of the opioid crisis is critical to craft effective policy aimed at reducing opioid addition and abuse. Opioid dependence and abuse results from a complex set of social, health, and economic factors. There is a deep academic literature studying the factors that have contributed to opioid-related overdose deaths going back to the early 1990s. In a review of this literature, King et al. (2014) identifies 17 determinants that have proven to contribute to opioid overdose deaths falling into three broad categories: prescriber behavior, user behavior and characteristics, and environmental and social factors. Research studying the current opioid crisis has focused on the rise in drug overdose deaths among white, prime-aged men with low educational attainment living in areas with high unemployment (Case and Deaton, 2015, 2017; Peirce and Schott, 2016; Rudd et al., 2016; Brown and Wehby, 2017; Carpenter et al., 2017; Hollingsworth et al., 2017).

In this section, we consider the relationship between several economic, demographic, and health factors and Ohio's recent opioid crisis. Table 4 presents the coefficient estimates produced by individually regressing a variety of economic, demographic, and health characteristics from 2010 on Ohio county drug overdose rates in 2015.⁶ This process tests for the statistical correlation between these socioeconomic factors and Ohio county overdose rates. We focus on this relationship because 2010 marked the beginning of the rapid rise in opioid overdose deaths in the state.

Economic Factors

Labor market conditions have recently been shown to have a strong relationship to the rise in opioid overdose deaths (Peirce and Schott, 2016; Brown and Wehby, 2017; Carpenter et al., 2017; Hollingsworth et al., 2017). As shown in Table 4, an Ohio county's unemployment rate in 2010 is positively correlated with overdose deaths in 2015. Thus, counties that were economically struggling in 2010 were more likely to have higher opioid overdose rates in 2015. Similarly, a higher labor participation rate in 2010 appears to be associated with a lower overdose death rate in 2015. Consistent with the public narrative, we find that counties that experienced a larger decline in manufacturing employment during the Great Recession had higher overdose rates in 2015.

⁶We use the overall drug overdose death as a proxy for opioid related overdose death because opioid related overdose is the major category among all drug related deaths.

TABLE 4. Regression Coefficients Estimating the Correlation Between Socioeconomic Factors and Overdose Mortality Rates⁷

Coefficients with 2015 Overdose Mortality Rate		
Economic Variables:		
Unemployment Rate	1.89	***
Labor Force Participation Rate	-0.44	*
% Change in Manufacturing Employment 2007 - 2010	-25.81	*
Poverty Rate	0.77	**
Median Income	-10.48	
Median Monthly Housing Cost	2.10	
Median Property Value	-3.38	
Intergenerational Mobility	-1.81	***
Demographic Characteristics:		
% of White Population	-0.54	***
% of Population between 25-34 Years Old	3.20	**
% of Population with at Least a High School Degree	-0.72	*
% of Married Population	-1.11	***
Health Factors:		
Percent insured ⁸	-0.03	
Opioid Prescriptions per Capita 2010	0.28	***
Opioid Prescriptions per Capita 2010 (Correlation with 2010 Overdose Mortality Rate)	0.16	***

Note: * significant at 10% level; ** significant at 5% level; *** significant at 1% level.

Each socioeconomic is individually regressed on the overdose mortality rate

Poverty is another factor often associated with drug overdose. Our results suggest that counties with a higher poverty rate in 2010 had high rates of overdose deaths in 2015. Interestingly, median income does not appear to be a statistically significant factor, although the coefficient is negative, suggesting that counties with higher median incomes in 2010 had lower overdose death rates in 2015, as we would expect. We suspect the lack of statistical significance could stem from a lack of statistical power in our sample.⁹ For similar reasons, the correlation for median property value and median monthly housing cost are not significant.

⁷ We collect most of our socioeconomic data from American Community Survey 2015 (five year estimate); social mobility from Chetty et al. (2014); opioid overdose and prescription data from Ohio Department of Health.

⁸ Percent insured in 2010 is not available. We use 2011 data here.

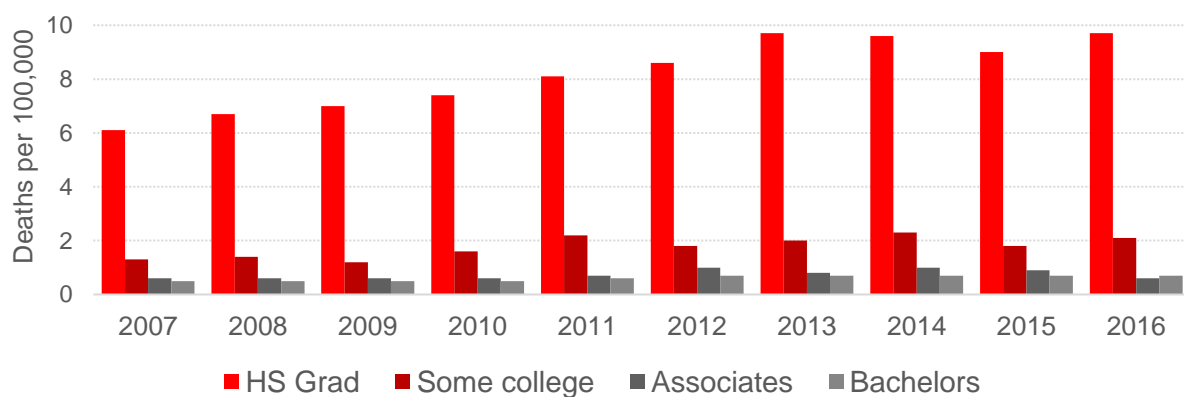
⁹ There are 88 counties in Ohio.

One narrative that has emerged to explain the rise of overdose deaths is the rise of “deaths of despair” (Case and Deaton, 2015). The story goes like this: low skill workers remember a time when their parents could support a family, buy a home, and have a valued place in society with only a high school degree. There is a sense that this life is no longer available to low skilled workers in today’s American economy as they are left behind by increasingly skilled work requirements. Such a realization, it is posited, leads to despair, drug use, and eventually overdose death. To consider this effect, we use a measure of “intergenerational mobility” from Chetty et al. (2014) as an indicator measuring how likely a child from a specific area is to earn more than their parents. We use county level intergenerational mobility data and find that an area’s mobility measure is negatively associated with opioid overdose mortality in Ohio. This result reveals the same nexus of poverty and opioid overdose: People living in Ohio counties with fewer economic opportunities were more likely to suffer from an overdose death in 2015.

Demographic Factors

While anecdotal media reports have highlighted addiction problems and overdoses across a wide ranging demographic, data points to a strong connection between educational attainment and overdoses in Ohio. Those who only have a high school degree have overdose death rates over 4.5 times higher than those with even just some college (Figure 5). When compared to those with a bachelor’s degree, those with just a high school degree have overdose death rates 14 times larger. This is consistent with the findings of Case and Deaton (2015) who found that increases in mortality rates for whites age 45-54 were driven entirely by those with a high school degree or less. In a follow-up study (Case and Deaton 2017), they found that not only are mortality rates diverging for non-Hispanic whites by education levels, but mortality is declining for those with a college degree and rising for those without. They attribute these trends to cumulative disadvantages in work, marriage, and health associated with those who only have a high school degree. Consistent with these findings, we find that overdose rates were higher in counties with lower marriage rates and lower high school graduation rates.

FIGURE 5: Ohio Overdose Rates by Education Level

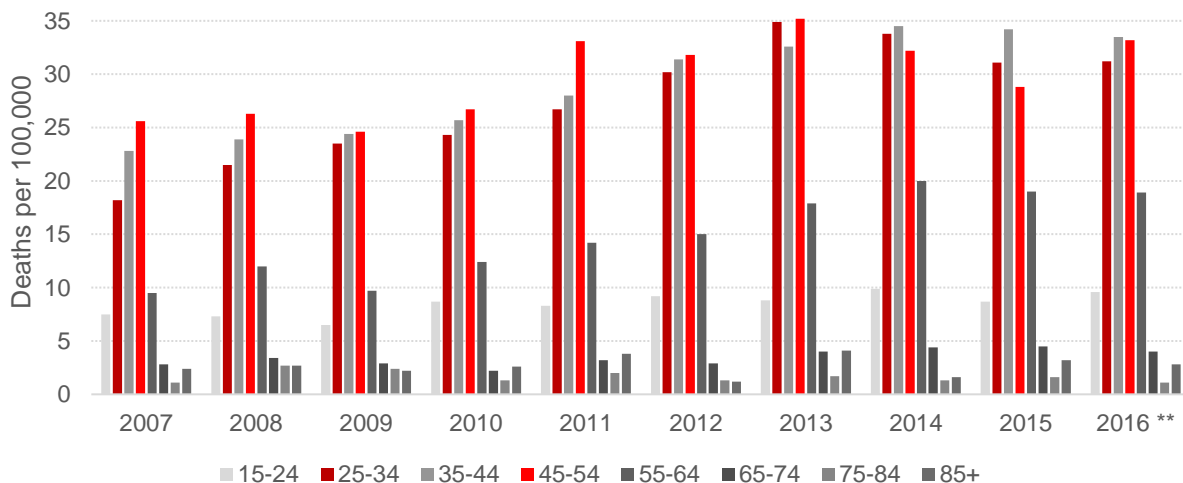


SOURCE: Ohio Public Health Data Warehouse. High school dropouts are not included in these numbers because the data source does not distinguish between high school dropouts and current students, skewing the measure.

Case and Deaton's work focuses primarily on whites age 45-54. If we look at the age profiles of overdose deaths in Ohio, we see middle-aged workers may have been a driving force at the beginning of the crisis, but as time has gone on overdose deaths have trended younger. By 2014, both overdose death rates for 25-34 year olds and 35-44 year olds had surpassed those of 45-54 year olds (Figure 6). In Table 4, we find that counties with a higher share of population between 25 and 34 years old had a higher overdose death rate in 2015. The takeaway is that overdose deaths are concentrated within the prime working years for Ohio's citizens, which will have increasing implications for the dynamism of Ohio's economy. Finally, it is worth noting that the male overdose rate is approximately double the female rate, which is consistent with national trends.

In Table 4, we find one result that runs counter to the dominant narrative connecting the overdose deaths to the white population. Instead, we find that counties with a larger white population had a lower overdose rate in 2015. While research has found that the recent rise in drug overdoses have largely been driven by the white population, people of color are still more likely to die of a drug overdose than white people in Ohio.

FIGURE 6: Ohio Overdose Rates by Age



SOURCE: Ohio Public Health Data Warehouse

Health Factors

It is often thought that the over-prescription of opioid pain medications is a key contributor to the current opioid epidemic. To consider this relationship, we correlate the overdose mortality rate with opioid prescriptions per capita for Ohio counties. We find a positive relationship, suggesting that counties that had higher opioid prescriptions per capita experienced higher opioid overdose

death rates. We also observe that this effect has increased overtime, from 0.16 in 2010 to 0.28 in 2015. This increasing relationship likely reflects the shift towards dangerous prescription opioid alternatives like heroin and fentanyl corresponding with the increased availability of these illicit drugs and increased state regulation of prescription opioids after 2010.

We also consider the relationship between the percent of the population insured in 2011 and opioid overdose death rates in 2015 (Table 4). We find that insurance rates did not have a statistically significant relationship with overdose rates. One possible explanation for this finding is that the insurance rates in a county can have offsetting effects on the opioid overdose death rate. When people have insurance, they have greater access to medical treatment that may help them avoid or overcome opioid dependence and abuse. This effect would lower the overdose rate. Yet, higher levels of insurance also likely correlates with increased access to prescription opioids, which as we have shown can lead to increased opioid overdose deaths.

IV. Access to Opioid Treatment

Reducing the rate of opioid addiction, abuse and overdose will require a broad range of policies, including ensuring that those that are opioid dependent are able to access treatment. Effective treatment for people suffering from opioid dependence must take into consideration the physical, emotional, and social factors that contribute to opioid abuse.

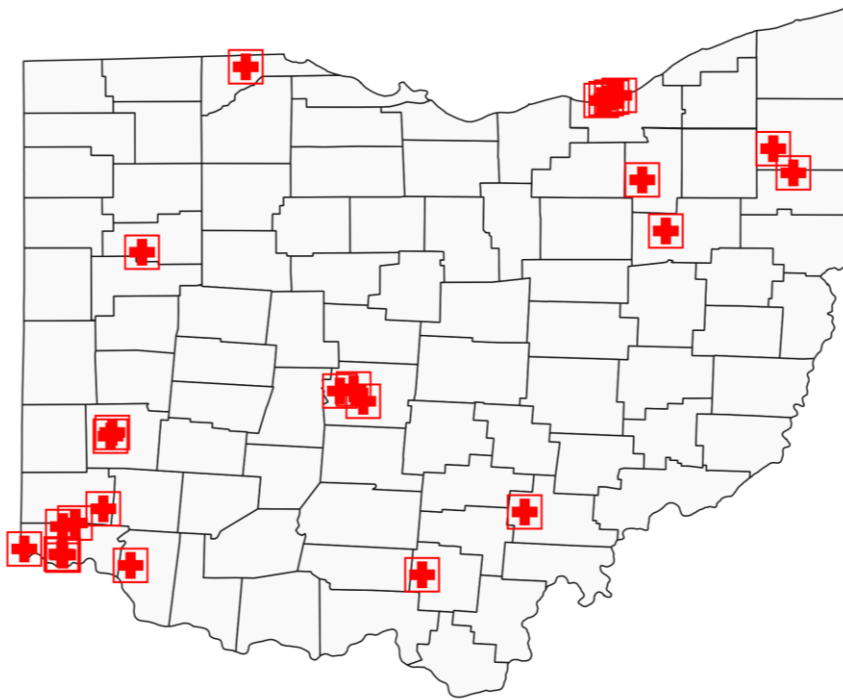
One essential component of a comprehensive opioid treatment is medication-assisted therapies (MAT) (Volkow et al., 2014). MATs are treatments that include the use of medications along with counseling and other supports. When properly administered, medication-assisted treatments have been shown to be the most effective method of treating opioid addiction and reducing overdose deaths by allowing the patient to regain a normal state of mind, reduce withdrawal symptoms, and manage opioid cravings (Connery, 2015). Given that opioid addiction is increasingly treated as a chronic disease like heart disease or diabetes, long-term access to physicians that can provide treatment and medication is critical to preventing recidivism.

There are three common medications used in the treatment of opioid addiction: methadone, buprenorphine, and naltrexone. Methadone and buprenorphine trick the brain into thinking that the body is getting the destructive opioid. The person taking these medications feels normal, not high, and the medication prevents withdrawal while reducing cravings. Methadone and buprenorphine treatments cost about \$6,500 per year (U.S. Department of Defense, 2016). Naltrexone works in a different way by blocking the effects of opioid drugs. As a result, a patient on naltrexone cannot get high, and it is most commonly used to help prevent relapse. Naltrexone is much more expensive than the other treatments, costing about \$14,000 per year (U.S. Department of Defense, 2016).

The administration of treatments for opioid abuse is regulated by the Substance Abuse and Mental Health Services Administration (SAMHSA). Methadone is the most highly regulated treatment and can only be administered by certified treatment facilities. Patients are required to visit these facilities each day to receive their methadone medication. Figure 7 maps the 26

certified methadone treatment centers in Ohio. The map shows clear disparities across Ohio counties in the access to methadone treatment centers. More than half of the centers are located in urban cores. Just two treatment centers are located in non-metro areas (Jackson, Ohio & Athens, Ohio). This low geographic distribution of methadone treatment centers presents a major barrier to treatment. Given that one must visit a methadone treatment center daily to receive the medication, most people in rural areas of Ohio are essentially left without access to this treatment.

FIGURE 7: Methadone Treatment Centers

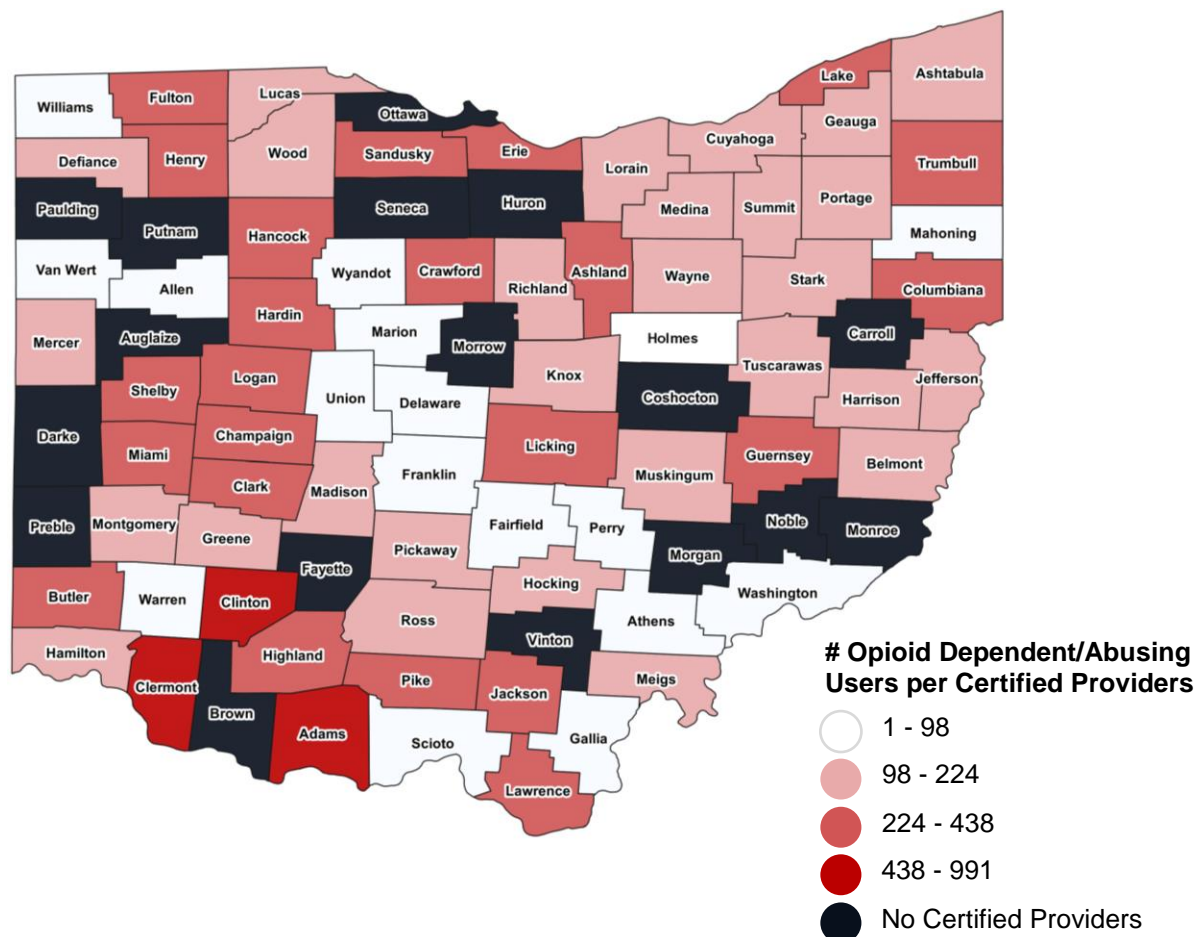


SOURCE: Substance Abuse and Mental Health Services Administration

Buprenorphine was the first drug approved to treat opioid abuse that can be prescribed or dispensed in physician offices. Buprenorphine is intended to greatly increase access to treatment, although it is still regulated by SAMSHA. Physicians must complete an opioid treatment training and obtain a waiver from SAMSHA to prescribe buprenorphine to patients. Waivers allow physicians to prescribe buprenorphine to 30 patients at a time, 100 patients at a time, or 275 patients at a time. In 2016, 273 physicians in Ohio were certified to treat 30 patients at a time, while 104 physicians were certified to treat 100 patients at a time. That means that just over 18,000 opioid dependent patients could have received buprenorphine treatment in 2016, assuming every certified physician treated the maximum number of patients. To put this into context, we estimate that between 92,000 and 170,000 Ohioans were abusing or

dependent upon opioids in 2015, which means that only 10 to 20 percent of those opioid users would have been able to receive buprenorphine treatment, assuming that all certified physicians treated the maximum number of patients. Including methadone treatment capacity, Jones et al. (2015) estimate that Ohio only had capacity to treat 40-percent of people with opioid dependency in 2012. Since then, overdoses have increased markedly, but treatment facilities have not.

FIGURE 8: Estimated Number of Dependent/Abusing Users per Providers Certified to Prescribe Buprenorphine



SOURCE: Abusing/Dependent Opioid Users – Authors' calculation; Certified Doctors - SAMHSA buprenorphine treatment locator

While buprenorphine expands the number of physicians that can use MATs to treat opioid abuse and dependence, access to certified physicians is not equally distributed across the state. Figure 8 shows the number of people abusing or dependent upon opioids (2015, authors' calculation) per certified doctor (2017, SAMSHA). The lightly shaded counties have the best

access to buprenorphine treatment. In these areas, doctors certified to treat at least 100 patients would be able to meet all of the need for treatment. The seventeen counties shaded black do not have any doctors certified to prescribe buprenorphine. While many of these counties had drug overdose rates well below the state average in 2015, Brown (58 overdoses per 100,000), Fayette (53.9 overdoses per 100,000) and Preble (40 overdoses per 100,000) had overdose rates that greatly exceeded the state average, yet have no doctors certified to prescribe buprenorphine. The area of greatest concern in Figure 8 is the region of southwest Ohio that includes Clinton, Fayette, Brown, Clermont, Adams, and Highland counties. Opioid dependence and abuse is very intense in this primarily rural region of the state, yet it has one of the lowest levels of treatment access in Ohio.

Naltrexone is the least regulated of the opioid treatment medications. Any doctor certified to prescribe medication can prescribe naltrexone. Yet, this does not necessarily mean it is more accessible. As we've noted, naltrexone treatment is more than twice as expensive as methadone and buprenorphine treatment. An additional barrier to accessing naltrexone is that it requires that a patient complete a detoxification from opioids before treatment can begin. The most common methods of medically assisted withdrawal from opioid dependence include prescribing either methadone or buprenorphine to control withdrawal symptoms. If dependent opioid users are unable to access the medical treatment they need to safely manage an opioid withdrawal, they are unlikely to reach a point at which naltrexone is a viable option for sustained treatment. Given these barriers, naltrexone is most commonly used by drug courts in Ohio as a treatment for people arrested for drug related crimes.

Medication-assisted treatment has been shown to be a cost-effective approach to treating opioid addiction. It has been estimated that for every dollar spent on methadone and buprenorphine treatment, \$1.80 in social savings would be realized (Institute for Clinical and Economic Review, 2014). Most of these savings are achieved through reduced medical spending. Lynch et al. (2014) estimate that treating opioid dependent patients using buprenorphine and addiction counseling can reduce annual medical expenses for opioid dependent patients by \$20,000 per year.

Increasing access and utilization of medication-assisted treatment is critical for Ohio to address the opioid crisis. As we have emphasized, ensuring that dependent opioid users have access to trained prescribers is an essential aspect of opioid treatment, and should be a priority for the state. There are additional policy issues that are also important to consider. Policies related to how public and private insurers manage the utilization of opioid treatment, limits on dosages prescribed, annual and lifetime medication limits, and cumbersome processes to authorize and reauthorize treatment all potentially limit the access and effectiveness of opioid treatment (American Society of Addiction Medicine, 2013).

V. Conclusions & Policy Discussion

Opioid addiction, abuse, and overdose deaths have had devastating effects on families and communities in Ohio. State and local policymakers have rightly given this issue significant attention. As we've noted, opioid abuse and dependence in Ohio likely generates between \$6 and \$8 billion in annual costs. Ohio's latest biennium budget passed in 2017 allocated \$170 million in funding to address the opioid epidemic through programs addressing mental health, child and family welfare, criminal justice, and assistance to local governments. Additionally, Ohio adopted new rules in August 2017 requiring that physicians, doctors, and physician assistants provide details on the diagnosis and procedures when opioids are prescribed to patients. The policy aims to reduce the over-prescription of opioids, and medical professionals will face sanctions if they are found to be over-prescribing.

Yet, these policies overlook the most glaring opportunity to reduce opioid abuse and overdose deaths: increase access to treatment. Medical research has consistently found that medication-assisted treatment is the most clinically and cost effective means of reducing opioid abuse and overdose deaths. Yet, as we show in Figures 7 and 8, many Ohioans have either limited or no access to medical providers that can treat their addiction. We estimate that only 10 percent to 20 percent of Ohioans that are addicted to or abusing opioids could be treated with buprenorphine given the number of certified physicians. As we've noted, access to treatment varies widely across the state, with many residents in rural counties completely lacking access to opioid treatment.

The state should make increasing access to office based buprenorphine treatment a top priority. Research has found that Medicaid support and state efforts to educate physicians on appropriate buprenorphine usage can increase the number of physicians that can prescribe buprenorphine in a state (Stein et al., 2016). One of the best examples of state efforts to increase access to office based opioid treatment (OBOT) is Vermont. In 2000, Vermont was one of eight states in the US without any opioid abuse treatment providers, forcing residents to travel to neighboring states to get treatment. Today, Vermont has excess capacity to treat opioid addiction (Vestal, 2016). This remarkable increase in access to opioid treatment was achieved through the implementation of a novel hub and spoke based model which connected regional opioid addiction treatment centers with "spoke" providers certified to prescribe buprenorphine, including family practitioners, internists, psychiatrists, obstetricians, private group practices, hospital-owned practices, and solo practices (Brooklyn & Sigman, 2015). Patients are referred to a hub or a spoke based on their particular medical needs, and hubs provide regular support and training to spoke physicians treating opioid addiction. Because of this program, nearly 75-percent of the patients diagnosed with an opioid use disorder in Vermont were receiving medication assisted treatment by the end of 2014. In 2015, Vermont's opioid overdose death rate was 13.7 per 100,000 people compared to 31.3 per 100,000 in neighboring New Hampshire.

While increasing access to opioid treatment can help to address the short-term crisis, Ohio should also consider policies that seek to reduce long-run drug abuse. In response to skyrocketing overdose rates, states began to address the problem by trying to stop the flow of prescription opioids. Many states implemented prescription drug monitoring programs, some of which were of the more highly effective “must access” laws that required physicians to check prescription databases before prescribing opioid pain relievers. In many of the “must access” states, including Ohio, prescription rates came down significantly. Unfortunately, the declining availability of controlled prescription opioids likely forced those with an opioid dependence to street drugs like heroin, fentanyl, and carfentanil, resulting in a sharp increase in the overdose rate. This—along with simultaneous rises in suicide and liver disease death rates—suggests that while controlling the supply of both legal and illegal opioids has a role in the solution to the opioid epidemic, addressing the underlying factors that have contributed to increased demand for such highly addictive substances, especially among those with low education levels, is central to long-term solutions to the crisis.

Emerging research has found that unemployment and underemployment may be linked to increased demand for opioids (Case and Deaton 2017; Hollingsworth, Ruhm, and Simon 2016). Labor market prospects for those without a college education have declined considerably in the past several decades. The college wage premium—the average earnings difference between college and high school educated workers—has increased significantly since the mid-1960s. In 1965, high school graduates earned about 77% of college graduate salaries. By 2013 that had decreased to 62%. Maybe even more important is that high school educated workers not only lost ground relative to college workers, but in absolute terms as well. High school graduates now earn about 10% less than their counterparts in the 1960s, after accounting for inflation (Pew Research Center). Rural areas have been especially affected by these trends. Rural areas still lag metro areas in education (USDA 1), leaving them more susceptible to the overdose epidemic. Apart from education levels, rural areas have lagged metro areas coming out of the Great Recession, with slower employment and population growth (USDA 2), further creating conditions for high opioid use in non-metro areas. Ohio has largely followed those national trends. However, it is important to recognize that the opioid epidemic is not a singularly urban or rural issue. Montgomery County, part of the Dayton metro area, has the highest overdose rate in the state, and four of the ten counties with the highest overdose rates are rural.

The labor force participation rate in the U.S. has declined considerably since 2000 and has now reached a 40-year low. Some of this is due to retirements in the baby boomer generation, but a significant share is from prime-age men leaving the labor force (Krueger 2017). Recent work on the connection between opioid use and labor force participation has found that half of the prime age men who are not in labor force use pain medication daily, and nearly two-thirds of those use prescription pain medication (Krueger 2017). However, more research is needed to determine whether opioids are keeping prime-age men from the labor force, men who have given up hopes of meaningful employment have turned to opioids, or opioids have been prescribed to men experiencing legitimate pain that has kept them from working.

Ohio in particular has seen declines in manufacturing jobs over the past 40 years, but an even sharper drop since 2000, which is right about the time overdose deaths began to rise sharply.

Automation and outsourcing have eliminated most of these jobs and have contributed to the decline in employment prospects for those at the low end of the educational distribution. Recent research has found that one more robot per thousand workers reduces the employment/population ratio by about 0.18-0.24 percentage points (Acemoglu and Restrepo 2017). Other work has found that counties that were more greatly impacted by the permanent normalization of trade relations with China exhibit higher rates of suicide and related causes of death, concentrated among whites, especially white males (Pierce and Schott 2016). While federal policymakers can take steps to ease the impacts of international trade deals by providing ample lead time for workers to transition out of their current jobs, it is unlikely policymakers can influence the pace of innovation and automation without having serious negative consequences for the overall economy. Automation and outsourcing will likely continue to play a large role in Ohio's labor markets, especially so in the case of automation. In previous decades changes to the labor market were slower, giving workers more time to adjust and find alternative employment. The rate of technological advancement and global communications have rapidly changed, meaning that the U.S. needs new policies that match the pace of industry innovation to help workers through disruptive labor-market transitions.

There are no easy policy levers that will quickly improve the labor market prospects of Ohioans with a high school degree or less. How to effectively help older jobless workers has long been a perplexing problem for economists. Public programs to retrain workers for higher skill jobs have not had a particularly strong track record and enrolling in higher education has lower returns for older workers because they have a shorter time horizon to reap the benefits of a college education. The increasing disparity between college and high school worker earnings and the resultant health consequences have increased the benefit to cost ratio of a college degree, but those too are in part offset by increasing tuition costs.

Over the long term, the prospects of positively influencing individual labor market outcomes is better. Increasingly, sound research is demonstrating the importance of early childhood interventions, especially for those born into poor families and communities, in improving a child's labor market prospects as an adult (Bartik, Gormley, and Adelstein 2012; Heckman et al. 2010). Earlier educational investments and increased educational investments over the life course, including reducing barriers to higher education for poorer households, will decrease the percentage of adults that believe they have little to offer the labor market. There are no quick fixes to the opioid crisis, but continued investment the education, skills, physical health, and mental health of Ohio's citizens will yield healthier communities with less drug overdoses in the long run.

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